Analysis of Mercury Control Costs in Wisconsin

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The costs for controlling mercury emissions from power plants has been the subject of many recent investigations, but it is clear that there have been a number of inflated estimates that have not taken into account the savings that would occur as technologies develop, regulatory drivers are put in place, and multipollutant controls are considered.

Costs for utilities in Wisconsin to control mercury emissions are calculated here based on an EPA assessment conducted in preparation for the regulatory determination issued in December 2000.[1] That assessment focused on injecting powdered activated carbon (PAC) into the flue gas, to trap gas phase mercury upstream of existing particulate matter pollution control equipment.

Existing controls in place (as of 1999) at Wisconsin coal-fired power plants for sulfur dioxide (SO_2), nitrogen oxides (NOx), and particulate matter (PM), are as follows:[2]

Existing Pollution Control Devices for Three Pollutants at Wisconsin Coal-Fired Power Plants

Sulfur Dioxide		Nitrogen Oxides		Particulate Matter	
Control	**No. Boilers**	**Control**	**No. Boilers**	**Control**	**No. Boilers**
None	13	None	18	Cold-side electrostatic precipitators*	30
Compliance coal	20	Low-NOx burners (several technologies)	18	Hot-side electrostatic precipitators	7
Low sulfur coal	7	NA	6	Fabric filter	4
Dry sorbent injection	2			Bahco Multiclone	1

*: Includes two units with cyclone modification

In addition, in 1999, average sulfur content of coal received at Wisconsin utilities was 0.39 percent[3]. Reported principal coal type burned at the facilities was bituminous at 15 boilers, subbituminous at 15, and both types at the other 12 boilers; in terms of capacity, percent of total capacity for the three coal types was: bituminous: 17.3 percent; subbituminous: 47.5 percent; and both types: 35.2 percent. [4]

In the EPA cost assessment, several model plants (based on size, coal type and percent sulfur, and control configuration) were used. Those scenarios, and cost estimates for 80 - 95 percent mercury control on an energy basis are given below:

Mercury Control Costs (80 - 95 Percent Reduction) For Two Model Power Plants[5]

Size (MW)	Coal Type	% Sulfur	Costs[a] (Mills/kW-hr)
100	Bituminous	0.6	0.610 - 1.076
100	Subbituminous	0.5	0.69 – 1.149

Note: Existing control is cold-side electrostatic precipitator; mercury control would add spray cooling (SC) upstream of PAC injection location.
a: Projected cost estimate ranges.

A rough calculation of mercury control costs is based on the ESP-4 scenario utilized in the EPA assessment, and the coal types used in Wisconsin in 1999. For simplicity, based on data on coal type presented above, it was assumed that in Wisconsin, 34.9 percent of electricity sales from power plants would derive from bituminous coal, and 65.1 percent from subbituminous.

Based on Wisconsin coal-fired power plant generation of 39,786 MW-hr of energy in 1998,[6] and an assumed increase in electricity generation of 2.4 percent per year by 2010,[7] estimated costs for controlling mercury at the 80 - 95 percent level would range from $35 - $59.4 million/year. (This range is close to what would be predicted based on scaling to Wisconsin's electric power generation the national cost estimates of $1.7 – 2.7 billion/year based on use of composite adsorbents (PAC and lime) or PAC alone.[8]) In addition, it is highly likely that as technology develops, the costs for activated carbon injection – including the possibility of developing better sorbents - would drop significantly.

In an earlier national estimate EPA noted that estimated national costs of a 70 percent mercury MACT (along with controls for sulfur dioxide and carbon dioxide abatement) would be $1.5 billion/year, as compared to projected electricity sales of $194 billion in 2010.[9] These costs would amount to about 0.2 – 0.3 cents/kWh, or about a two to three percent increase on the typical monthly bill.[10]

The above estimates for mercury control from power plants are less than those estimated by EPA just three years earlier in the Mercury Report to Congress. This pattern is consistent with the experience with emissions controls implemented to reduce acid rain. As noted in a recent report, costs for controlling nitrogen oxide and sulfur dioxide emissions "tended to fall dramatically as control technologies passed from the conceptual research and development phase to full-scale demonstration and commercialization."[11] In 1989, industry estimated compliance costs for nitrogen oxide and sulfur dioxide controls of $4.7 – 6.6 billion/year; by 1997, industry estimates had fallen to $1.5 – 2.1 billion/year.[12]

In addition, benefits accruing to public health and the environment from reduced mercury pollution have not been taken into account. In its 1999 assessment of control costs for four pollutants, the EPA noted earlier findings that benefits for SO2 reductions alone in the Eastern U.S., with reductions in SO2 emissions of 50 percent below Title IV levels, would amount to $12 billion to $61 billion annually.[13]

In summary, the costs of controlling mercury emissions from coal-fired power plants are already economical for utilities, and when taking into account both technology development and the adoption of additional programs for reducing other pollutants, control costs will almost surely decline farther.

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[1] U.S. EPA, *Performance and Costs of Mercury Emission Control Technology Applications on Electric Utility Boilers*, EPA-600/R-00-083, Sept. 2000.
[2] U.S. EPA, Information Collection Request, 1999, faclpart2.xls file, accessed at http://www.epa.gov/ttn/atw/combust/utiltox/
[3] U.S. Department of Energy, Energy Information Administration, *Coal Industry Annual 1999*, Table 106.
[4] U.S. EPA, 1999, ICR, *Op. Cit.*
[5] U.S. EPA, 2000, *Op. Cit.*
[6] U.S. DOE, *State Electricity Profiles*, http://www.eia.doe.gov/cneaf/electricity/st_profiles/toc.html
[7] Public Service Commission of Wisconsin, Strategic Energy Assessment, Final Report, December 2000.
[8] ICF Consulting, memorandum from Kamala R. Jayaraman, Juanita M. Haydel, and Boddu N. Venkatesh to Mary Jo Krolewski, Gene Hua Sun (U.S. EPA), Sept. 30,2000.
[9] U.S. EPA, *Analysis of Emissions Reduction Options for the Electric Power Industry*, April, 1999. Figures in 1990 dollars.
[10] Joint Boiler Workgroup, of the Acid Rain Steering Committee & Mercury Task Force, of the Conference of New England Governors and Eastern Canadian Premiers Committee on the Environment, *Technology Options and Recommendations for Reducing Mercury and Acid Rain Precursor Emissions from Boilers*, July 2000
[11] Northeast States for Coordinated Air Use Management, (NESCAUM), *Environmental Regulation and Technology Innovation: Controlling Mercury Emissions from Coal-Fired Boilers*
[12] *Ibid.*
[13] U.S. EPA, 1999, *Op. Cit.*